



Sequence Listing NREL 99-45 sent 5-28-04.txt  
SEQUENCE LISTING

<110> National Renewable Energy Laboratory  
<120> cellobiohydrolase I Gene and Improved Variants  
<130> NREL 99-45  
<140> 10/031,496  
<141> 2002-01-14  
<160> 120  
<170> PatentIn version 3.2  
<210> 1  
<211> 28  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR  
<400> 1  
agagagtcta gacacggagc ttacaggc 28  
  
<210> 2  
<211> 35  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR  
<400> 2  
aaagaagcgc ggccgcgcct gcactctcca atcgg 35  
  
<210> 3  
<211> 24  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR  
<400> 3  
ggcggaaacc cgcctggcac cacc 24  
  
<210> 4  
<211> 1550  
<212> DNA  
<213> Trichoderma reesei  
  
<220>  
<221> misc\_signal  
<222> (1)..(51)  
  
<220>  
<221> CDS  
<222> (3)..(1550)  
<220>

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<221> misc\_feature

<222> (52)..(1344)

<220>

<221> misc\_feature

<222> (1345)..(1435)

<220>

<221> misc\_binding

<222> (1436)..(1550)

<400> 4

at	gta	tcg	gaa	gtt	ggc	cgt	cat	ctc	ggc	ctt	ctt	ggc	cac	agc	tcg	47
	Val	Ser	Glu	Val	Gly	Arg	His	Leu	Gly	Leu	Leu	Gly	His	Ser	Ser	
	1				5				10						15	

tgc	tca	gtc	ggc	ctg	cac	tct	cca	atc	gga	gac	tca	ccc	gcc	tct	gac	95
Cys	Ser	Val	Gly	Leu	His	Ser	Pro	Ile	Gly	Asp	Ser	Pro	Ala	Ser	Asp	
				20					25					30		

atg	gca	gaa	atg	ctc	gtc	tgg	tgg	cac	gtg	cac	tca	aca	gac	agg	ctc	143
Met	Ala	Glu	Met	Leu	Val	Trp	Trp	His	Val	His	Ser	Thr	Asp	Arg	Leu	
			35					40					45			

cgt	ggt	cat	cga	cgc	caa	ctg	gcg	ctg	gac	tca	cgc	tac	gaa	cag	cag	191
Arg	Gly	His	Arg	Arg	Gln	Leu	Ala	Leu	Asp	Ser	Arg	Tyr	Glu	Gln	Gln	
		50				55						60				

cac	gaa	ctg	cta	cga	tgg	caa	cac	ttg	gag	ctc	gac	cct	atg	tcc	tga	239
His	Glu	Leu	Leu	Arg	Trp	Gln	His	Leu	Glu	Leu	Asp	Pro	Met	Ser		
	65					70					75					

caa	cga	gac	ctg	cgc	gaa	gaa	ctg	ctg	tct	gga	cgg	tgc	cgc	cta	cgc	287
Gln	Arg	Asp	Leu	Arg	Glu	Glu	Leu	Leu	Ser	Gly	Arg	Cys	Arg	Leu	Arg	
	80					85					90					

gtc	cac	gta	cgg	agt	tac	cac	gag	cgg	taa	cag	cct	ctc	cat	tgg	ctt	335
Val	His	Val	Arg	Ser	Tyr	His	Glu	Arg		Gln	Pro	Leu	His	Trp	Leu	
95					100						105					

tgt	cac	cca	gtc	tgc	gca	gaa	gaa	cgt	tgg	cgc	tcg	cct	tta	cct	tat	383
Cys	His	Pro	Val	Cys	Ala	Glu	Glu	Arg	Trp	Arg	Ser	Pro	Leu	Pro	Tyr	
110					115					120					125	

ggc	gag	cga	cac	gac	cta	cca	gga	att	cac	cct	gct	tgg	caa	cga	gtt	431
Gly	Glu	Arg	His	Asp	Leu	Pro	Gly	Ile	His	Pro	Ala	Trp	Gln	Arg	Val	
				130					135					140		

ctc	ttt	cga	tgt	tga	tgt	ttc	gca	gct	gcc	gtg	cgg	ctt	gaa	cgg	agc	479
Leu	Phe	Arg	Cys		Cys	Phe	Ala	Ala	Ala	Val	Arg	Leu	Glu	Arg	Ser	
			145						150					155		

tct	cta	ctt	cgt	gtc	cat	gga	cgc	gga	tgg	tgg	cgt	gag	caa	gta	tcc	527
Ser	Leu	Leu	Arg	Val	His	Gly	Arg	Gly	Trp	Trp	Arg	Glu	Gln	Val	Ser	
			160					165					170			

cac	caa	cac	cgc	tgg	cgc	caa	gta	cgg	cac	ggg	gta	ctg	tga	cag	cca	575
His	Gln	His	Arg	Trp	Arg	Gln	Val	Arg	His	Gly	Val	Leu		Gln	Pro	
		175					180					185				

gtg	tcc	ccg	cga	tct	gaa	gtt	cat	caa	tgg	cca	ggc	caa	cgt	tga	ggg	623
Val	Ser	Pro	Arg	Ser	Glu	Val	His	Gln	Trp	Pro	Gly	Gln	Arg		Gly	
		190					195					200				

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ctg gga gcc gtc atc caa caa cgc gaa cac ggg cat tgg agg aca cgg Leu Gly Ala Val Ile Gln Gln Arg Glu His Gly His Trp Arg Thr Arg 205 210 215	671
aag ctg ctg ctc tga gat gga tat ctg gga ggc caa ctc cat ctc cga Lys Leu Leu Leu Asp Gly Tyr Leu Gly Gly Gln Leu His Leu Arg 220 225 230	719
ggc tct tac ccc cca ccc ttg cac gac tgt cgg cca gga gat ctg cga Gly Ser Tyr Pro Pro Pro Leu His Asp Cys Arg Pro Gly Asp Leu Arg 235 240 245	767
ggg tga tgg gtg cgg cgg aac tta ctc cga taa cag ata tgg cgg cac Gly Trp Val Arg Arg Asn Leu Leu Arg Gln Ile Trp Arg His 250 255 260	815
ttg cga tcc cga tgg ctg cga ctg gaa ccc ata ccg cct ggg caa cac Leu Arg Ser Arg Trp Leu Arg Leu Glu Pro Ile Pro Pro Gly Gln His 265 270 275	863
cag ctt cta cgg ccc tgg ctc aag ctt tac cct cga tac cac caa gaa Gln Leu Leu Arg Pro Trp Leu Lys Leu Tyr Pro Arg Tyr His Gln Glu 280 285 290 295	911
att gac cgt tgt cac cca gtt cga gac gtc ggg tgc cat caa ccg ata Ile Asp Arg Cys His Pro Val Arg Asp Val Gly Cys His Gln Pro Ile 300 305 310	959
cta tgt cca gaa tgg cgt cac ttt cca gca gcc caa cgc cga gct tgg Leu Cys Pro Glu Trp Arg His Phe Pro Ala Ala Gln Arg Arg Ala Trp 315 320 325	1007
tag tta ctc tgg caa cga gct caa cga tga tta ctg cac agc tga gga Leu Leu Trp Gln Arg Ala Gln Arg Leu Leu His Ser Gly 330 335 340	1055
ggc aga att cgg cgg atc ctc ttt ctc aga caa ggg cgg cct gac tca Gly Arg Ile Arg Arg Ile Leu Phe Leu Arg Gln Gly Arg Pro Asp Ser 345 350 355	1103
gtt caa gaa ggc tac ctc tgg cgg cat ggt tct ggt cat gag tct gtg Val Gln Glu Gly Tyr Leu Trp Arg His Gly Ser Gly His Glu Ser Val 360 365 370	1151
gga tga tta cta cgc caa cat gct gtg gct gga ctc cac cta ccc gac Gly Leu Leu Arg Gln His Ala Val Ala Gly Leu His Leu Pro Asp 375 380 385	1199
aaa cga gac ctc ctc cac acc cgg tgc cgt gcg cgg aag ctg ctc cac Lys Arg Asp Leu Leu His Thr Arg Cys Arg Ala Arg Lys Leu Leu His 390 395 400	1247
cag ctc cgg tgt ccc tgc tca ggt cga atc tca gtc tcc caa cgc caa Gln Leu Arg Cys Pro Cys Ser Gly Arg Ile Ser Val Ser Gln Arg Gln 405 410 415	1295
ggt cac ctt ctc caa cat caa gtt cgg acc cat tgg cag cac cgg caa Gly His Leu Leu Gln His Gln Val Arg Thr His Trp Gln His Arg Gln 420 425 430 435	1343
ccc tag cgg cgg caa ccc tcc cgg cgg aaa ccc gcc tgg cac cac cac Pro Arg Arg Gln Pro Ser Arg Arg Lys Pro Ala Trp His His His 440 445 450	1391

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 440 445 450

cac ccg ccg ccc agc cac tac cac tgg aag ctc tcc cgg acc tac cca 1439  
 His Pro Pro Pro Ser His Tyr His Trp Lys Leu Ser Arg Thr Tyr Pro  
 455 460 465

gtc tca cta cgg cca gtg cgg cgg tat tgg cta cag cgg ccc cac ggt 1487  
 Val Ser Leu Arg Pro Val Arg Arg Tyr Trp Leu Gln Arg Pro His Gly  
 470 475 480

ctg cgc cag cgg cac aac ttg cca ggt cct gmc cct tac tac tct cag 1535  
 Leu Arg Gln Arg His Asn Leu Pro Gly Pro Xaa Pro Tyr Tyr Ser Gln  
 485 490 495

tgc ctg taa agc tcc 1550  
 Cys Leu Ser Ser  
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<210> 5  
 <211> 78  
 <212> PRT  
 <213> Trichoderma reesei  
 <400> 5

val Ser Glu val Gly Arg His Leu Gly Leu Leu Gly His Ser Ser Cys  
 1 5 10 15

Ser Val Gly Leu His Ser Pro Ile Gly Asp Ser Pro Ala Ser Asp Met  
 20 25 30

Ala Glu Met Leu Val Trp Trp His Val His Ser Thr Asp Arg Leu Arg  
 35 40 45

Gly His Arg Arg Gln Leu Ala Leu Asp Ser Arg Tyr Glu Gln Gln His  
 50 55 60

Glu Leu Leu Arg Trp Gln His Leu Glu Leu Asp Pro Met Ser  
 65 70 75

<210> 6  
 <211> 25  
 <212> PRT  
 <213> Trichoderma reesei  
 <400> 6

Gln Arg Asp Leu Arg Glu Glu Leu Leu Ser Gly Arg Cys Arg Leu Arg  
 1 5 10 15

val His val Arg Ser Tyr His Glu Arg  
 20 25

<210> 7  
 <211> 42

Sequence Listing NREL 99-45 sent 5-28-04.txt

<212> PRT

<213> Trichoderma reesei

<400> 7

Gln Pro Leu His Trp Leu Cys His Pro Val Cys Ala Glu Glu Arg Trp  
1 5 10 15

Arg Ser Pro Leu Pro Tyr Gly Glu Arg His Asp Leu Pro Gly Ile His  
20 25 30

Pro Ala Trp Gln Arg Val Leu Phe Arg Cys  
35 40

<210> 8

<211> 40

<212> PRT

<213> Trichoderma reesei

<400> 8

Cys Phe Ala Ala Ala Val Arg Leu Glu Arg Ser Ser Leu Leu Arg Val  
1 5 10 15

His Gly Arg Gly Trp Trp Arg Glu Gln Val Ser His Gln His Arg Trp  
20 25 30

Arg Gln Val Arg His Gly Val Leu  
35 40

<210> 9

<211> 16

<212> PRT

<213> Trichoderma reesei

<400> 9

Gln Pro Val Ser Pro Arg Ser Glu Val His Gln Trp Pro Gly Gln Arg  
1 5 10 15

<210> 10

<211> 21

<212> PRT

<213> Trichoderma reesei

<400> 10

Gly Leu Gly Ala Val Ile Gln Gln Arg Glu His Gly His Trp Arg Thr  
1 5 10 15

Arg Lys Leu Leu Leu  
20

<210> 11

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<211> 28

<212> PRT

<213> Trichoderma reesei

<400> 11

Asp Gly Tyr Leu Gly Gly Gln Leu His Leu Arg Gly Ser Tyr Pro Pro  
1 5 10 15

Pro Leu His Asp Cys Arg Pro Gly Asp Leu Arg Gly  
20 25

<210> 12

<211> 8

<212> PRT

<213> Trichoderma reesei

<400> 12

Trp Val Arg Arg Asn Leu Leu Arg  
1 5

<210> 13

<211> 69

<212> PRT

<213> Trichoderma reesei

<400> 13

Gln Ile Trp Arg His Leu Arg Ser Arg Trp Leu Arg Leu Glu Pro Ile  
1 5 10 15

Pro Pro Gly Gln His Gln Leu Leu Arg Pro Trp Leu Lys Leu Tyr Pro  
20 25 30

Arg Tyr His Gln Glu Ile Asp Arg Cys His Pro Val Arg Asp Val Gly  
35 40 45

Cys His Gln Pro Ile Leu Cys Pro Glu Trp Arg His Phe Pro Ala Ala  
50 55 60

Gln Arg Arg Ala Trp  
65

<210> 14

<211> 8

<212> PRT

<213> Trichoderma reesei

<400> 14

Leu Leu Trp Gln Arg Ala Gln Arg  
1 5

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<210> 15  
 <211> 4  
 <212> PRT  
 <213> Trichoderma reesei

<400> 15

Leu Leu His Ser  
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<210> 16  
 <211> 34  
 <212> PRT  
 <213> Trichoderma reesei

<400> 16

Gly Gly Arg Ile Arg Arg Ile Leu Phe Leu Arg Gln Gly Arg Pro Asp  
 1 5 10 15

Ser Val Gln Glu Gly Tyr Leu Trp Arg His Gly Ser Gly His Glu Ser  
 20 25 30

Val Gly

<210> 17  
 <211> 63  
 <212> PRT  
 <213> Trichoderma reesei

<400> 17

Leu Leu Arg Gln His Ala Val Ala Gly Leu His Leu Pro Asp Lys Arg  
 1 5 10 15

Asp Leu Leu His Thr Arg Cys Arg Ala Arg Lys Leu Leu His Gln Leu  
 20 25 30

Arg Cys Pro Cys Ser Gly Arg Ile Ser Val Ser Gln Arg Gln Gly His  
 35 40 45

Leu Leu Gln His Gln Val Arg Thr His Trp Gln His Arg Gln Pro  
 50 55 60

<210> 18  
 <211> 64  
 <212> PRT  
 <213> Trichoderma reesei

<220>  
 <221> misc\_feature  
 <222> (57)..(57)  
 <223> The 'xaa' at location 57 stands for Asp, or Ala.

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<400> 18

Arg Arg Gln Pro Ser Arg Arg Lys Pro Ala Trp His His His His Pro  
1 5 10 15

Pro Pro Ser His Tyr His Trp Lys Leu Ser Arg Thr Tyr Pro Val Ser  
20 25 30

Leu Arg Pro Val Arg Arg Tyr Trp Leu Gln Arg Pro His Gly Leu Arg  
35 40 45

Gln Arg His Asn Leu Pro Gly Pro Xaa Pro Tyr Tyr Ser Gln Cys Leu  
50 55 60

<210> 19

<211> 78

<212> PRT

<213> Trichoderma reesei

<400> 19

Val Ser Gln Val Gly Arg His Leu Gly Leu Leu Gly His Ser Ser Cys  
1 5 10 15

Ser Val Gly Leu His Ser Pro Ile Gly Asp Ser Pro Ala Ser Asp Met  
20 25 30

Ala Gln Met Leu Val Trp Trp His Val His Ser Thr Asp Arg Leu Arg  
35 40 45

His Gly Arg Arg Gln Leu Ala Leu Asp Ser Arg Tyr Glu Gln Gln His  
50 55 60

Glu Leu Leu Arg Trp Gln His Leu Glu Leu Asp Pro Leu Ser  
65 70 75

<210> 20

<211> 25

<212> PRT

<213> Trichoderma reesei

<400> 20

Gln Arg Asp Leu Arg Glu Glu Leu Leu Ser Gly Arg Cys Arg Leu Arg  
1 5 10 15

Val His Val Arg Ser Tyr His Gln Arg  
20 25

<210> 21

<211> 42

<212> PRT



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<213> Trichoderma reesei

<400> 21

Gln Pro Leu His Trp Leu Cys His Pro Val Cys Ala Glu Glu Arg Trp  
1 5 10 15

Arg Ser Pro Leu Pro Tyr Gly Glu Arg His Asp Leu Pro Gly Ile His  
20 25 30

Pro Ala Trp Gln Arg Val Leu Phe Arg Cys  
35 40

<210> 22

<211> 40

<212> PRT

<213> Trichoderma reesei

<400> 22

Cys Phe Ala Ala Ala Val Arg Leu Glu Arg Ser Ser Leu Leu Arg Val  
1 5 10 15

His Gly Arg Gly Trp Trp Arg Glu Gln Val Ser His Gln His Arg Trp  
20 25 30

Arg Gln Val Arg His Gly Val Leu  
35 40

<210> 23

<211> 16

<212> PRT

<213> Trichoderma reesei

<400> 23

Gln Pro Val Ser Pro Arg Ser Glu Val His Gln Trp Pro Gly Gln Arg  
1 5 10 15

<210> 24

<211> 21

<212> PRT

<213> Trichoderma reesei

<400> 24

Gly Leu Gly Ala Val Ile Gln Gln Arg Glu His Gly His Trp Arg Thr  
1 5 10 15

Arg Lys Leu Leu Leu  
20

<210> 25

<211> 28

Sequence Listing NREL 99-45 sent 5-28-04.txt

<212> PRT

<213> Trichoderma reesei

<400> 25

Asp Gly Tyr Leu Gly Gly Gln Leu His Leu Arg Gly Ser Tyr Pro Pro  
1 5 10 15

Pro Leu His Asp Cys Arg Pro Gly Asp Leu Arg Gly  
20 25

<210> 26

<211> 8

<212> PRT

<213> Trichoderma reesei

<400> 26

Trp Val Arg Arg Asn Leu Leu Arg  
1 5

<210> 27

<211> 69

<212> PRT

<213> Trichoderma reesei

<400> 27

Gln Ile Trp Arg His Leu Arg Ser Arg Trp Leu Arg Leu Glu Pro Ile  
1 5 10 15

Pro Pro Gly Gln His Gln Leu Leu Arg Pro Trp Leu Lys Leu Tyr Pro  
20 25 30

Arg Tyr His Gln Glu Ile Asp Arg Cys His Pro Val Arg Asp Val Gly  
35 40 45

Cys His Gln Pro Ile Leu Cys Pro Glu Trp Arg His Phe Pro Ala Ala  
50 55 60

Gln Arg Arg Ala Trp  
65

<210> 28

<211> 8

<212> PRT

<213> Trichoderma reesei

<400> 28

Leu Leu Trp Gln Arg Ala Gln Arg  
1 5

<210> 29

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<211> 4  
 <212> PRT  
 <213> Trichoderma reesei

<400> 29

Leu Leu His Ser  
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<210> 30  
 <211> 34  
 <212> PRT  
 <213> Trichoderma reesei

<400> 30

Gly Gly Arg Ile Arg Arg Ile Leu Phe Leu Arg Gln Gly Arg Pro Asp  
 1 5 10 15

Ser Val Gln Glu Gly Tyr Leu Trp Arg His Gly Ser Gly His Glu Ser  
 20 25 30

Val Gly

<210> 31  
 <211> 63  
 <212> PRT  
 <213> Trichoderma reesei

<400> 31

Leu Leu Arg Gln His Ala Val Ala Gly Leu His Leu Pro Asp Lys Arg  
 1 5 10 15

Asp Leu Leu His Thr Arg Cys Arg Ala Arg Lys Leu Leu His Gln Leu  
 20 25 30

Arg Cys Pro Cys Ser Gly Arg Ile Ser Val Ser Gln Arg Gln Gly His  
 35 40 45

Leu Leu Gln His Gln Val Arg Thr His Trp Gln His Arg Gln Pro  
 50 55 60

<210> 32  
 <211> 64  
 <212> PRT  
 <213> Trichoderma reesei

<220>  
 <221> misc\_feature  
 <222> (57)..(57)  
 <223> The 'xaa' at location 57 stands for Asp or Ala

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<400> 32

Arg Arg Gln Pro Ser Arg Arg Lys Pro Ala Trp His His His His Pro  
1 5 10 15

Pro Pro Ser His Tyr His Trp Lys Leu Ser Arg Thr Tyr Pro Val Ser  
20 25 30

Leu Arg Pro Val Arg Arg Tyr Trp Leu Gln Arg Pro His Gly Leu Arg  
35 40 45

Gln Arg His Asn Leu Pro Gly Pro Xaa Pro Tyr Tyr Ser Gln Cys Leu  
50 55 60

<210> 33

<211> 45

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 33

cctcccggcg gaaacccgcc tggcaccacc accacccgcc gccca

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<210> 34

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 34

ggactcacgc tacggccagc agcacgaact gc

32

<210> 35

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 35

cccataccgc ctgggcgcca ccagcttcta cggccc

36

<210> 36

<211> 41

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 36

ggactccacc tacccgacag ccgagacctc ctccacaccc g

41

<210> 37

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<211>	26	
<212>	DNA	
<213>	Artificial Sequence	
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<223>	Primer for PCR	
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	gcactctcca atcggagact caccgc	26
<210>	38	
<211>	26	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	38	
	gcactctcca accggagact caccgc	26
<210>	39	
<211>	26	
<212>	DNA	
<213>	Sythetic DNA	
<400>	39	
	cgggtgagtc tccggttgga gagtgc	26
<210>	40	
<211>	28	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	40	
	ggcacgtgca ctcaacagac aggctccg	28
<210>	41	
<211>	28	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	41	
	ggcacgtgca ctccacagac aggctccg	28
<210>	42	
<211>	28	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	42	
	cggagcctgt ctgtggagtg cacgtgcc	28

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<210>	43	
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<212>	DNA	
<213>	Artificial Sequence	
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<223>	Primer for PCR	
<400>	43	
	ggcgctggac tcacgctacg aacagcagca cg	32
<210>	44	
<211>	32	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	44	
	ggcgctggac tcaccctacg aacagcagca cg	32
<210>	45	
<211>	32	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	45	
	cgtgctgctg ttcgtagggt gagtccagcg cc	32
<210>	46	
<211>	26	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	46	
	gctgtctgga cggtgccgcc tacgcg	26
<210>	47	
<211>	26	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	47	
	gctgtctgga ccctgccgcc tacgcg	26
<210>	48	
<211>	26	
<212>	DNA	
<213>	Artificial Sequence	
<220>		
<223>	Primer for PCR	
<400>	48	

Sequence Listing NREL 99-45 sent 5-28-04.txt 26  
cgcgtaggcg gcagggtcca gacagc

<210> 49  
<211> 24  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR

<400> 49 24  
gcctctccat tggctttgtc accc

<210> 50  
<211> 24  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR

<400> 50 24  
gcctctccat tccctttgtc accc

<210> 51  
<211> 24  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR

<400> 51 24  
gggtgacaaa gggaaatggag aggc

<210> 52  
<211> 24  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR

<400> 52 24  
ggccaacggt gagggctggg agcc

<210> 53  
<211> 24  
<212> DNA  
<213> Artificial Sequence  
<220>  
<223> Primer for PCR

<400> 53 24  
ggccaacggt ccgggctggg agcc

<210> 54  
<211> 24  
<212> DNA  
<213> Artificial Sequence  
<220>

Sequence Listing NREL 99-45 sent 5-28-04.txt

<223> Primer for PCR

<400> 54

ggctcccagc ccggaacggt ggcc

24

<210> 55

<211> 27

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 55

ggctgggagc cgatcatcaa caacgcg

27

<210> 56

<211> 27

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 56

ggctgggagc cgccatcaa caacgcg

27

<210> 57

<211> 27

<212> DNA

<213> Artificial Sequence

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<223> Primer for PCR

<400> 57

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27

<210> 58

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 58

cgataccacc aagaaattga ccggtgtcac cc

32

<210> 59

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 59

cgataccacc aagccattga ccggtgtcac cc

32

<210> 60

<211> 32



Sequence Listing NREL 99-45 sent 5-28-04.txt

<212> DNA  
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 <400> 60  
 gggtgacaac ggtcaatggc ttggtggtat cg 32  
  
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 <400> 61  
 cgagacgtcg ggtgccatca accgatac 28  
  
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 <400> 62  
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 <211> 28  
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 gtatcggttg atgggacccg acgtctcg 28  
  
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 <211> 35  
 <212> DNA  
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 <220>  
 <223> Primer for PCR  
  
 <400> 64  
 ggcgtcactt tccagcagcc caacgccgag cttgg 35  
  
 <210> 65  
 <211> 35  
 <212> DNA  
 <213> Artificial Sequence  
 <220>  
 <223> Primer for PCR  
  
 <400> 65  
 ggcgtcactt tcccgcagcc ccccgccgag cttgg 35

Sequence Listing NREL 99-45 sent 5-28-04.txt

<210>	66	
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<212>	DNA	
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	ccaagctcgg cggggggctg cgggaaagtg acgcc	35
<210>	67	
<211>	26	
<212>	DNA	
<213>	Artificial Sequence	
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<400>	67	
	ggctacctct ggcggcatgg ttctgg	26
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<211>	26	
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<213>	Artificial Sequence	
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<223>	Primer for PCR	
<400>	68	
	ggctacctct cccggcatgg ttctgg	26
<210>	69	
<211>	26	
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<223>	Primer for PCR	
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<210>	70	
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	gcggaagctg ctccaccagc tccggtgtcc ctgc	34
<210>	71	
<211>	34	
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Sequence Listing NREL 99-45 sent 5-28-04.txt

<400> 71  
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<210> 72  
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<400> 72  
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<210> 73  
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<400> 73  
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<400> 74  
gtctcccaac cccaagtca cc 22

<210> 75  
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<400> 75  
ggtgaccttg gggttgggag ac 22

<210> 76  
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<400> 76  
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Sequence Listing NREL 99-45 sent 5-28-04.txt

<220>  
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<210> 78  
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 <220>  
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<400> 78  
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<210> 79  
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<400> 79  
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<210> 80  
 <211> 36  
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<400> 80  
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<210> 81  
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<400> 81  
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<210> 82  
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<400> 82  
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<210> 83

Sequence Listing NREL 99-45 sent 5-28-04.txt

<211> 20  
 <212> DNA  
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 <223> Primer for PCR  
  
 <400> 83  
 ccgataacgc ctatggcggc 20  
  
 <210> 84  
 <211> 20  
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 <400> 84  
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 <400> 85  
 cccggtgccg tgcgcggaag ctgctccacc 30  
  
 <210> 86  
 <211> 30  
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 <400> 86  
 cccggtgccg tggccggaag ctgctccacc 30  
  
 <210> 87  
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 <212> DNA  
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 <400> 87  
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 <212> DNA  
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 <220>  
 <223> Primer for PCR  
  
 <400> 88  
 gctgaggagg cagaattcgg cggatcctct ttctc 35

Sequence Listing NREL 99-45 sent 5-28-04.txt

<210> 89  
 <211> 35  
 <212> DNA  
 <213> Artificial Sequence  
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<400> 89  
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<210> 90  
 <211> 35  
 <212> DNA  
 <213> Artificial Sequence  
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<400> 90  
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<210> 91  
 <211> 29  
 <212> DNA  
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<400> 91  
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<210> 92  
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<400> 92  
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<210> 93  
 <211> 29  
 <212> DNA  
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 <220>  
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<400> 93  
 gctggtgttg cccagggcgt atgggttcc 29

<210> 94  
 <211> 34  
 <212> DNA  
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Sequence Listing NREL 99-45 sent 5-28-04.txt

<400> 94  
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<210> 95  
<211> 34  
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<400> 95  
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<210> 96  
<211> 34  
<212> DNA  
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<220>  
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<400> 96  
ccgggtgtgg aggaggtggc gtttgtcggg tagg 34

<210> 97  
<211> 32  
<212> DNA  
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<220>  
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<400> 97  
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<210> 98  
<211> 32  
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<400> 98  
gcagttcgtg ctgctggccg tagcgtgagt cc 32

<210> 99  
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<400> 99  
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<210> 100  
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<212> DNA

Sequence Listing NREL 99-45 sent 5-28-04.txt

<213> Artificial Sequence  
 <220>  
 <223> Primer for PCR  
  
 <400> 100  
 gggccgtaga agctggtggc gccaggcgg tatggg 36  
  
 <210> 101  
 <211> 41  
 <212> DNA  
 <213> Artificial Sequence  
 <220>  
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 <400> 101  
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 <210> 102  
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 <212> DNA  
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 <211> 23  
 <212> DNA  
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 <223> Primer for PCR  
  
 <400> 103  
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 <210> 104  
 <211> 23  
 <212> DNA  
 <213> Artificial Sequence  
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 <400> 104  
 gctgaggagg cacgcttcgg cgg 23  
  
 <210> 105  
 <211> 23  
 <212> DNA  
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 <220>  
 <223> Primer for PCR  
  
 <400> 105  
 ccgccgaagc gtgcctcctc agc 23



Sequence Listing NREL 99-45 sent 5-28-04.txt

<210> 106  
 <211> 27  
 <212> DNA  
 <213> Artificial Sequence  
 <220>  
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 <400> 106  
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<210> 107  
 <211> 27  
 <212> DNA  
 <213> Artificial Sequence  
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 <400> 107  
 ggcaacgagc tcgacgatga ttactgc 27

<210> 108  
 <211> 27  
 <212> DNA  
 <213> Artificial Sequence  
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 <400> 108  
 gcagtaatca tcgtcagagct cgttgcc 27

<210> 109  
 <211> 35  
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 <213> Artificial Sequence  
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 <223> Primer for PCR  
 <400> 109  
 ccggtgtccc tgctcaggtc gaatctcagt ctccc 35

<210> 110  
 <211> 35  
 <212> DNA  
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 <220>  
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 <400> 110  
 ccggtgtccc tgatcaggtc gaatctcagt ctccc 35

<210> 111  
 <211> 35  
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 <220>  
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 <400> 111

Sequence Listing NREL 99-45 sent 5-28-04.txt 35  
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<210> 112  
 <211> 30  
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<400> 112 30  
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<210> 113  
 <211> 30  
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<400> 113 30  
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<210> 114  
 <211> 30  
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 <220>  
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<400> 114 30  
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<210> 115  
 <211> 29  
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 <220>  
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<400> 115 29  
 ccctatgtcc tgacaacgag acctgcgcg

<210> 116  
 <211> 29  
 <212> DNA  
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 <220>  
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<400> 116 29  
 ccctatgtcc tgacgacgag acctgcgcg

<210> 117  
 <211> 29  
 <212> DNA  
 <213> Artificial Sequence  
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Sequence Listing NREL 99-45 sent 5-28-04.txt

<223> Primer for PCR

<400> 117

cgcgagggtc tcgtcgtag gacataggg

29

<210> 118

<211> 44

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 118

gctcgaccct atgtcctgac aacgagacct gcgcgaagaa ctgc

44

<210> 119

<211> 44

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 119

gctcgaccct atgtcctgac gacgagacct gcgcgaagaa ctgc

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<210> 120

<211> 44

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer for PCR

<400> 120

gcagttcttc gcgcaggtct cgtagtcagg acataggggc gagc

44